Container and a Lock therefor

In the household, and in other areas, it is often necessary to store products, for example foods and beverages and also other products, tightly sealed and/or in a low-oxygen atmosphere.

The object of the invention is to present a container that enables this in an improved manner. A container is embodied correspondingly according to claim 1. A closure is the subject of claim 53. A valve is embodied according to claim 87.

The container according to the invention is designed so that after being filled with the respective product, a vacuum can be applied to the closed container or its interior by manual deformation of at least one wall section, not only reducing the oxygen content in the container but also sealing the container especially tightly and with a high closing force.

The vacuum in the interior of the container can be produced in a wide variety of manners, for example by manually pressing in one elastic wall section of the container body and/or of the closure or by compressing or pressing together the container body or lower container element and/or the closure in one direction of the container axis, etc.

Further embodiments of the inventions are the subject matter of the dependent claims.

The invention is described below based on numerous exemplary embodiments with reference to Figures 1 – 77.

Figures 1 – 4 show one possible embodiment in side view, top view and in cross section of an airtight container 1, which is used in particular for storing food, but also for other products that need to be kept fresh.

The container 1 consists essentially of a lower container element 2, which is designed in the shape of a bowl and can be sealed tightly by placing a lid 3 on its top, open side. The lid 3 comprises a lid bottom 4 and a lid edge 5, the latter overlapping the top container edge 6 of the closed container 1 with a circular groove formed on the inside and outside of the lid edge.

The bottom 4 is formed in one section by an elastically deformable bottom area 4.1 (membrane). This bottom area 4.1 is designed so that it is deformable in the manner of a bellows or membrane while exhibiting a high restoring force. Figure 3 shows the bottom area 4.1 in its non-deformed condition. Figure 4 shows the bottom area 4.1 in a deformed condition, i.e. pressed into the interior of the container. The bottom section 4.1 consists of a permanently elastic material with a high restoring force, i.e. with a restoring force of 100% or virtually 100%. A suitable product for this would be, for example, a product with the brand name "Styroflex" available from BASF.

On the bottom 4 of the lid 3 outside of the bottom section 4.1, a valve is provided that can be manually opened and closed, in the manner that an axially movable cap 7.2 is provided on a cylinder-shaped valve body 7.1 formed onto the lid bottom 4, said cap releasing an opening of the valve body 7.1 in its raised position from valve 1 depicted in Figure 3 and closing the opening of the valve body 7.1 and therefore of the valve 7 in its position depicted in Figure 4.

A product is stored by placing it in the open container element 2. Afterwards, the container element 2 is closed with the lid 3 and, with the valve 7 open, the bottom section 4.1 is pressed manually into the interior of the container, causing air to be displaced from the interior of the container via the opened valve 7. Afterwards, while the bottom sections 4.1 is still deformed, the valve is closed, so that the restoring force of the bottom section 4.1 causes a vacuum in the interior of the container, which (vacuum) prolongs the freshness of the product inside the container and ensures pressing of the lid 3 against the container element 2 with a high closing force, thus sealing the container 1 reliably and tightly.

Figures 5 – 7 show in depictions similar to Figures 1 – 4 as a further possible embodiment a container 1a, which comprises a container body 2a and a lid 3a and differs from the container 1a only in that instead of the manually controllable valve 7, an automatic valve 8 is provided. The latter consists of a valve housing 9 formed into the lid bottom 4 outside of the bottom section 4.1 with a valve opening 10 and a valve seat enclosing said valve opening, and of a valve body 11, which is fastened in the valve housing 9 in a suitable manner, for example by being screwed in or locked into place.

As depicted in Figures 8 and 9, the valve body 11 consists of two parts with differing elasticity, namely of the part shown in these figures as the upper part 11.1, with which the valve body 11 is held in the valve housing 9 or in the recess forming said housing and which is made of a harder material, and of the valve body sections 11.2, which is made of a soft elastic material and forms the part of the valve body 11 that works together with the valve seat. Just as the other parts of the container 1a, the valve body 11 is made of plastic, namely as a two-component injection-molded part. Figure 8 shows the valve 8 in closed condition. Figure 9 shows the valve 8 in closed condition. If the bottom area 4.1 is pressed manually into the interior of the container after closing the container 1a, the thus compressed air can escape from the interior of the container through the valve 8, i.e. by elastic deformation of the valve body section 11.2, namely through the valve opening 10 in the area of the opened valve seat and along the axial grooves 12, which are provided on the inner surface of the valve housing 9. If the pressed down or deformed bottom section 4.1 is released, it returns to its original position due to its restoring force. The lack of internal pressure in the container 1a causes the valve 8 to close automatically. This causes a vacuum to form in the interior of the container 1a, prolonging the storage life of the product in the interior of the container and also ensuring a high closing force of the container lid 3a, also as a result of the large-surface design of the container lid 3a.

Figures 10 and 11 show as a further embodiment a container 1b, which comprises a container body 2b and a lid 3b and which largely corresponds to the container 1a. The elastically deformable bottom section 4.1 of this container or container lid 3b is manufactured as a separate element, which is connected with the remaining container lid 3b in a suitable manner, for example by being pressed on, screwed on or another suitable method. In this embodiment it is possible to manufacture the lid 3b (with the exception of the bottom section 4.1) of a hard, less elastic material, for example plastic, and to use a material with higher elasticity, but a high restoring force, for the bottom section 4.1.

Figures 12 and 13 show a container 1c, which comprises a container body 2c and a lid 3c and which differs form the container of Figures 1 – 4 essentially in that instead of the valve 7, a closure plug 14 is provided for closing an opening in the container lid 3c and is connected with the remaining lid 3c by means of a flexible connector 15. The closure plug 14 is for example

formed onto the remaining lid with the connector 15 or is manufactured as a separate molded part and connected with the lid 3c.

Figures 14 and 15 show as a further possible embodiment a container 1d, which comprises a container body 2d and a lid 3d and in which the valve is provided not in the container lid, but rather in the peripheral wall of the container body 2d, namely in the immediate proximity of the container edge 6, wherein a valve corresponding to the valve 8 is used. Other valves can be provided as well. The container lid is made in this embodiment entirely of the flexible material with a high restoring force, and in this embodiment also the lid edge is made of the permanently elastic material, which further improves the seal of the closed container.

Figures 16 and 17 show as a further possible embodiment a container 1e, consisting of the lower container element 2e and the container lid 3e. In the depicted embodiment, a valve 8 is provided in the center of the lid. The peripheral wall of the lower container element 2e in this embodiment is designed with a section 15 made of the permanently elastic material with a high restoring force. The section 15 in the depicted embodiment extends over one partial section of the periphery of the lower element 2e. The manner of operation and use of this container correspond to those of the containers described above, i.e. after closing the lid 3e the section 15 is manually deformed into the interior of the container, causing air to be displaced from the interior of the container via the valve 8, which then after releasing the section 15 closes so that as a result of the restoring force of the section 15 a vacuum forms in the interior of the container.

Figures 19 and 20 show a container 1f consisting of the lower container element 2f and the lid 3f. The valve is again provided in the lid 3f, namely the valve 8 in the depicted embodiment. The lower container element 2f is designed in one peripheral area 16 in the form of an accordion, so that the lower element 2f can be pressed together in the manner of an accordion by pressing on the top of the container 1f or on the lid 3f located there, likewise in order to displace the air from the interior of the container. After it is released, the lower container element 2f returns at least approximately to its original condition due to the restoring force of the area 16, again causing a vacuum in the interior of the container.

Figures 21 and 22 show a container 1g, similar to the container 1f, with a lower container element 2g and a container lid 3g. This container differs from the container 1f in that a ring-shaped reinforcement 17 formed from a soft elastic material, e.g. soft elastic plastic or rubber, is provided on the outside of the accordion-like area 16 and is molded on, clipped on or fastened in another suitable manner for increasing the restoring force.

Figures 23 and 24 show a container 1h corresponding to the container 1f with a lower container element 2h, the peripheral wall of which is bulged convexly so that the creation of the vacuum in the interior of the container when sealed with the lid 3h again can be achieved by compressing the container axially. The valve 8 is located on the lid.

Figures 25 and 26 show a container 1i corresponding to the container 1h, with a lower container element 2i and a container lid 3i. On the inner side of the likewise convexly shaped peripheral wall of the lower container element 2i there are reinforcing elements 18 that work in the manner of a spring and are molded on and/or injected molded, but can also be fastened there in any other manner in order to increase the restoring force and therefore the vacuum that can be attained in the sealed interior of the container.

While the lower container element 2 – 2e has a flat design, Figures 27 – 30 show a container 1k, the lower container element 2k of which is designed as a can with a circular cylindrical peripheral wall. The lid 3k is adapted accordingly and comprises the elastically deformable lid bottom sections 4.1 with a high restoring force. The valve 8 is again provided on the lid 3k.

Figures 31 – 33 show as a further possible embodiment a container 1l, which consists of the lower container element 2l and the lid 3l comprising the valve 8 and which differs from the container 1k in that the lower container element can be compressed axially and for this purpose is designed with an accordion-like section corresponding to the section 16. The valve 8 is located in the center of the lid.

Figures 34 – 36 show a container 1m with a lower container element 2m and a lid 3m. The lid 3m can pivot on the lower container element 2m and can be locked in the closed position by

means of a clip closure 20. The valve 8 and the elastically deformable bellows-like area 4.1 are provided on the lid 3m.

Figures 37 – 40 show as a further possible embodiment a container 1n in the form of a butter dish. This container consists of the dome-shaped upper container element 3n and a board-like lower container element 2n, which forms the storage surface for a piece of butter 21 to be stored and is manufactured as one piece with an edge area with a circular groove 22, in which the lower edge 23 of the dome-shaped lid is held when the container 1n or dish is closed. The dome-shaped container lid 3n is provided with a section 24 corresponding to the section 16. Beneath the section 24, which directly adjoins the lid bottom, the valve 8 is located between said section and the edge 23.

Figures 41 – 44 show a container 1o with a lower element 2o and a dome-shaped lid 3o in the form of a butter dish. The edge 22 of the lower element 2o is provided with a ring-shaped, highly elastic seal 25, namely by the fact that said seal 25 engages with a lower circular strip-shaped section 25.1 in the circular groove 22 of the edge. On its top side facing away from the connecting piece 25.1 the seal 25 is provided with a circular groove 25.2, into which the edge 23 of the lid 3o engages when the dish is closed.

As shown particularly by Figures 42 – 44, the seal 25 is positioned between the edge 23 of the lid and the edge 22 of the lower element 2o when the lid is in closed position. Pressing the top side of the lid 3o causes the seal 25 to be elastically deformed (Fig. 44), so that the air is pressed outward from the closed interior of the container 1o via the valve 8 and the container 1o is held in closed position by the vacuum created in the interior of the container after releasing the lid.

In the depicted embodiment the seal 25 is a separate element of the container 1o. Of course, it is also possible to provide this seal permanently on the lower edge of the lid 3o or on the edge of the lower container element 2o by molding, by a two-component injection-molding process or in another suitable manner.

All embodiments described above have in common the fact that a protruding flat edge 26 or 27 is provided on the periphery of the lower container element 2 – 2o and on the periphery of the upper container element or of the container lid 3 – 3o. These edges are molded on, especially when the container or the components of the container are made of plastic.

Figures 45 – 47 show as a further possible embodiment a container 1p, which consists of an essentially cylindrical container body 2p and a lid 3p that can be screwed onto a reinforced container edge 28 or onto an outer thread located there. In closed condition a ring 29 is provided between the edge of the lid 3p and the edge 28, which (ring) serves to guarantee the original seal by engaging on the one hand by means of projections and catches with the lid 3p and on the other hand with the lower container element 2p or with the reinforced edge 29, so that opening the mouth of the container 1p is possible only by visibly destroying the ring 29. In one partial section 30 the peripheral wall of the lower container element 3p is designed in the manner of an accordion, so that the container can be compressed axially in this partial section, namely to produce the vacuum in the closed container, wherein after filling the container and after applying the securing ring 29, the lid 3p is screwed on so far that there is still an air gap between the lid and the container body 2p. The container is then compressed axially and the lid 3p is sealed tightly. The mouth of the container body 2p in this embodiment is approximately equal to the outer diameter of said body. The containers 1p can be stacked in closed condition. For this purpose a recess 31 is formed in the lid 3p, in which (recess) the lower edge 32 of the bottom, which has a reduced diameter, fits into an adjacent container in the stack.

Figures 48 – 51 show in various depictions as a further possible embodiment a container 1q, which consists of a lower container element with a square cross section and a screw-on lid 3q. The peripheral wall of the lower container element 2q is again provided with the accordion-like section 30 that can be compressed axially. The container opening in this embodiment has a cross section that is smaller than the cross section of the lower container element and is formed by a flange 33 on one shoulder, which is beveled on one side of the container and is otherwise horizontal. The outer thread for the lid 3q is also provided on the flange 33.

Figures 52 – 53 show a container 1r consisting of a bottle body 2r manufactured of an elastically

non-deformable material, for example of glass, and a lid 3r that can be placed on the mouth of the bottle. The lid consists of a ring-shaped lid element 34 that also forms the edge of the lid and is provided with a seal 35, in the depicted embodiment on the cylindrical or slightly conical inner surface of the lid edge enclosing the lid axis in a ring-like manner. The lid bottom is formed essentially by the bottom section 4.1 made of the permanently elastic material with a high restoring force. The lid 3r is placed, for example, with a manually deformed bottom section 4.1 onto the mouth of the bottle body 2r, so that after being closed, the bottom section 4.1, due to its restoring force, attempts to return to its original position, thus producing the vacuum in the closed container or in the closed bottle 1r.

Figures 54 and 55, 56 and 57, 58 and 59 show seals 36 – 38 for bottles 39. In the depicted embodiments the bottles 39 are designed at their bottle mouth so that they can be closed with a crown cap closure. The bottle 39 could of course also be designed with the usual screw thread at the top. Furthermore, the bottle 39 is made of glass, for example. The seals 36 – 38 are preferably reusable seals, namely for re-closing the respective bottle 39 after being opened the first time and while the contents of the bottle are in use. The bottle can again contain a wide variety of products, such as liquid foods or beverages, seasoning sauces (e.g. ketchup), etc.

All embodiments depicted in Figures 54 – 59 have in common that the closure is designed with an outwardly sealed hollow body with a relatively large volume and that said hollow body is made entirely or partially of an elastically deformable material with a high restoring force, so that in order to close the respective bottle 39, the seal 36 – 38 is placed on the top of the bottle in a manually deformed manner, thus initially sealing the bottle tightly. After releasing the closure, the latter attempts to return to its original form, thus producing the vacuum in the interior of the bottle 39 to protect the contents.

In the embodiment in Figures 54 and 55, the walls of the hollow body 36.1 forming the closure are made entirely of the permanently elastic material with a high restoring force, so that the hollow body, which in its original, non-deformed condition is essentially mushroom-shaped and in its deformed condition is pressed in on its top side in the manner of a trough (Fig. 55).

In the embodiment in Figures 56 and 57, the walls of the hollow body 37.1 are made of a harder or difficultly deformable material, for example of a suitable plastic or metal. A membrane-like section 40 made of the elastically deformable material with a high restoring force is provided on the top side. In its normal condition, this section 40 is essentially flat. In its deformed condition, the section 40 is pressed into the interior of the hollow body 37.1 and due to its restoring force, produces the vacuum not only in this hollow body, but also in the bottle 39.

In the embodiment in Figures 58 and 59 the hollow body 38.1 of the closure 38 is designed as a cylindrical chamber, with two essentially rigid ends 41 and 42 made of a non-deformable or difficultly deformable material, the end 41 forming the part of the closure to be fastened to the bottle mouth. The peripheral wall 43 between the two ends 41 and 42 is elastically deformable in the manner of a bellows, i.e. it is made of the elastically deformable material with a high restoring force. In this embodiment the wall sections 41 and 42 are likewise made of plastic or another suitable material. The elastically deformable peripheral wall 43 is connected with the wall sections 41 and 42 by means of molding or another suitable means.

Common to all embodiments in Figures 54 – 59 is an especially ergonomic design, because when the closure is placed on the bottle, the respective closure can very easily be deformed at the same time in order to create the vacuum in the closed bottle.

The closures 36 – 38 are adapted accordingly for use of the bottle with a screw thread on the bottle mouth.

Figures 60 – 62 show as a further possible embodiment a closure 44 for closing any type of containers, such as drinking vessels, drinking glasses, cups, but also suitable for packaging or eating containers, canned goods, yogurt cups, etc. This closure 44, which can be used for example as a re-closable closure or for closing the container until the container contents are used again, is designed essentially as a circular disk, consisting of a closure body 45 made of a harder, elastically non-deformable or difficultly deformable material, for example of a suitable plastic or metal. The closure body 45 is ring-shaped, with an opening in the center that is sealed by an insert or a membrane 46 made of the permanently elastic material with a high restoring

force. The closure body 45 is provided on the bottom with a layer 47 made of a highly elastic material, for example of a highly elastic plastic enclosing the membrane 46. This sealing layer 47 is designed as a separate seal or is fastened in a suitable manner on the closure body 45 or is held onto the latter by being molded on. On the top side facing away from the seal 47 the closure body 45 is provided with a protruding edge 48, so that it is possible for example, to place a container 49, after opening the container and removing the closure, on said closure, wherein the edge 48 forms a type of overflow guard. The membrane 46 is fastened to the mouth of the container body 45 in a suitable manner, for example by molding or injection molding, for which purpose the closure body 45 and the membrane 46 are manufactured for example of suitable plastics using a two-component injection molding process. If the seal 47 is also molded on, then the closure 44 is manufactured entirely in a three-component injection molding process.

The thickness of the seal 47 is relatively large, in order to compensate for uneven areas in the edge of the respective container or vessel 49.

The closure 47 is placed on the container 49 for example by deforming the membrane 46 with the thumb of one hand. Afterwards, while maintaining the deformation of the membrane 46, the closure 44 is pressed with the seal 47 against the edge of the mouth of the container 49. Then the membrane 46 is released, so that due to its elasticity and restoring force it attempts to return to its original position, thus again producing the vacuum in the interior of the closed container 49.

It is fundamentally possible in this embodiment to provide a valve, for example the valve 8, on the closure 44. In this case, the container 49 can be closed by placing the closure 44 onto the container 49 and then elastically deforming the membrane 46, thus displacing air from the interior of the closed container 49, producing the vacuum after releasing the membrane 46. The closure body 45 is provided on its circular ring-shaped peripheral surface with ribbing for a better grip.

In Figures 63 and 64, 50 designates a dispenser, in which a plurality of closures 44 can be stored and protected, in particular also from dust. The dispenser 50 consists essentially of a dome-shaped body, in which a plurality of closures 44 can be stacked on top of each other, with

the seal 47 downward and therefore protected against dust and dirt. The dispenser 50 is provided with two reach-through openings 51, so that the respective closure 44 can be removed from the dispenser 50 through said openings.

Figures 65 – 69 show in various depictions also together with the container 49 a closure 52, which can be used in place of the closure 44 and which has closure body 53 forming a deformable hollow body 53.1 with a high restoring force. On the bottom the closure 53 is again provided with the ring-shaped seal 47, which in this embodiment encloses an opening 54 of the interior of the hollow body 53.1. As shown in the figures, the closure 52, for a closure body 53 or hollow body 53.1 deformed on the top, is placed on the edge of the container 49 with the seal 47 and pressed against the edge of the container 49. Afterwards, the manually deformed hollow body 53.1 is released, so that the closure 52 is firmly attached to the container 49 by producing a vacuum in the interior of said container.

Figure 70 shows in various positions a1 / a2; b1 / b2; c1 / c2; d1 / d2 and e1 / e2 / e3 the embodiment of the seal area between a container body or lower element and a container lid, before and after closing, respectively.

In positions a1 and a2 the edge 55 of the lower container element is tapered toward the container mouth. The upper container element or the closure or lid of the container features a groove 56 adapted to this cross sectional form of the container edge 55 narrowing toward the bottom, so that this tapered or wedge-shaped form of the lid edge 55 and the corresponding form of the groove 56 achieve a tight closure without an additional seal or an additional soft part.

The positions b1 and b2 show an embodiment in which a continuous circular seal 57 made of a soft elastic material is provided in the groove 56 of the lid or closure. The seal is inserted for example as a separate element into the groove 56 and fastened there in a suitable manner, or preferably is produced by molding, for example in a two-component injection molding process together with the lid.

Positions c1 and c2 show an embodiment in which the closure or lid is made entirely of a

permanently elastic material, so that this material achieves an additional sealing effect when the container is closed.

Positions d1 and d2 show an embodiment similar to the embodiment of positions b1 and b2, wherein however in this embodiment a seal corresponding to the seal 57 is provided on the mouth edge 55.

Positions e1 – e3 again show the embodiment of the seal, as it was described in connection with the container 1o (Figures 41 – 44).

This seal 25, the use of which of course is not limited to the container 1o, not only functions as a seal, but at the same time also forms an elastically deformable element closing the interior of the respective container with a sufficiently high restoring force to produce a high vacuum in the interior of the container.

Figures 71 – 73 show as a further possible embodiment a container in the form of a plastic bottle with a container or bottle body 2s and a screw-on closure 3s. The bottle body is provided in one partial area of its periphery with an accordion-like deformable area 59, so that the bottle can be compressed axially before being closed, after which the vacuum is produced in the bottle through the restoring force of the section 59.

Similar embodiments are shown in Figures 74 and 75 (container 1t) and Figures 76 and 77 (container 1u), wherein in these cases the container or bottle body 2t features on its periphery an area formed by a reduction 61 at which the container body 2t can be deformed axially, so that when the container is closed, the vacuum is produced in the interior of the container through the restoring force of the section 60 or of the material of the container body 2t. The container 1u is provided with, in place of the reduction, a bulge on its container or bottle body 2u, enabling a corresponding axial deformation of the container. The containers 1t and 1u are likewise made of a suitable plastic, for example PET.

If the containers 1s – 1u are to be used for a carbonated product, for example for carbonated

beverages such as mineral water, soft drinks, etc., then additional means can be provided to prevent unwanted extension of the container at the deformable areas 59 – 61 after being filled with the carbonated product. This is achieved for example by having the accordion-like area 59 extend only over a correspondingly short part of the height of the bottle body and/or by additionally providing stops or belts to limit the axial expansion of the bottle body 2s. The reduction 60 or bulge 61 ensures sufficient stability of the bottle or container body 2t or 2u against unwanted axial extension even in the event of high internal pressure (for example 6 – 7 bar).

The invention was described above based on numerous exemplary embodiments. It goes without saying that diverse variations from these exemplary embodiments are possible; in particular, it is possible to combine the described exemplary embodiments or single characteristics of these exemplary embodiments in a variety of manners.

Reference list

1 - 1u	container
2 - 2u	container body or lower part of container
3 - 3u	container lid
4	bottom of container lid
4.1	elastically deformable bottom section
5	edge of lid
6	edge of container
7	manually controllable valve
7.1	valve body
7.2	valve cap
8	valve
9	valve housing
10	valve opening with valve seat
11	valve body
11.1	hard part of valve body 11
11.2	elastically deformable part of valve body 11
12	grooves
13	opening
14	plug
15, 16	peripheral area
17	bracing element
18	reinforcing element
19	deformable section
20	clip closure
21	piece of butter
22, 23	edge area
24	deformable section
25	seal
25.1	strip-shaped projection of seal 25
25.2	groove of seal 25
26, 27, 28	edge
29	ring

30	section
31	recess
32	edge
33	opening flange
34	lid section
35	seal
36, 37, 38	closure
36.1 ,37.1, 38.1	hollow body
39	bottle
40	section
41, 42	end wall
43	elastically deformable section
44	closure
45	closure body
46	elastically deformable membrane with high restoring force
47	seal
48	edge
49	container
50	dispenser for closures 44
51	reach-through opening
52	closure
53	closure body
53.1	hollow body
54	opening
55	edge of container
56	lid groove
57, 58	seal
59	accordion-like section
60	reduction
61	bulge